‘ASK A QUESTION!’

Using speaking and listening skills to think deeply about science

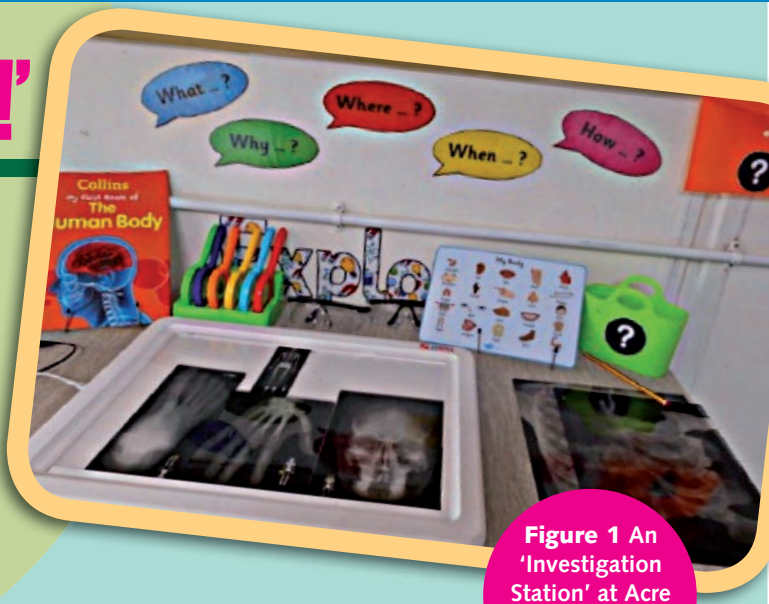


Figure 1 An ‘Investigation Station’ at Acre Rigg Infant School

Rachel Simpson and three primary science leaders, **Judy Ramshaw, Sarah Lewis** and **Aleesha Hoggarth**, describe how they have raised the profile of science in schools through an alliance between science and literacy

Science takes third place in the primary classroom, although children love it!

This commonly held view in primary education provided the motivation for a team of Initial Teacher Education (ITE) tutors at Durham University to work with science leaders in a Teaching School Alliance in County Durham. After a series of planning meetings, a project entitled ‘A Year of Science: using speaking and listening skills to think deeply about science’ was developed.

Launching the project

The project was launched at a conference in September 2017, when 300 teachers from 30 schools were introduced to the idea of developing children’s skills of questioning, reasoning and explanation in science. At the conference, science leaders audited their teachers’ views about primary science education. This provided a starting point for schools’ action research projects, developed by each science leader. University staff offered guidance about conducting action research through a series of network meetings during the year, using the structure shown in Figure 2.

Engaging the pupils

To ensure the children were involved from the outset, the project was launched at a children’s science day in October. Each school led an engaging science activity, designed to encourage children to ask questions about their scientific observations. Durham University ITE students supported the children, including participating in a debate on ‘*Which was the most important invention: plastic, electricity, or the wheel?*’ Special guest ‘Michael Faraday’ (Dr Simon Rees, chemistry education specialist at Durham University) delivered an adapted version of a Royal Institution lecture in period costume, which thrilled the audience – although the cry of ‘Oh dear!’ could be heard when a blowtorch was brought out! As well as being highly entertaining, this lecture introduced the children to the importance of scientists being able to communicate their ideas to an audience.

Figure 2 Structure of the action research projects

Later in March, an inter-school competition was held in a lecture auditorium at the university. School teams led presentations about a scientist they considered to be the most influential, with choices ranging from Charles Darwin, to Mary Anning, to Joseph Swan. The standard was incredibly high, and the judges were very impressed with the children’s knowledge of the scientists, their articulacy and the highly creative presentations. This time, ‘Faraday’ captivated his audience with a fire extinguisher and pillowcase demonstration – with the caution that perhaps this should not be tried back in the classroom!

Sharing outcomes

At the final subject leaders’ network meeting in July, the outcomes of the action research projects were presented. This was an opportunity to share exemplary practice and next steps for science in each school, which are now being considered by the science subject leaders through a peer review process.

Three of the schools’ projects are outlined here.

Key words: Cross-curricular Literacy Speaking

A Year of Science at Acre Rigg Infant School

Judy Ramshaw

Our aims

Our audit of teachers' views about primary science education identified four main challenges surrounding the teaching and learning of science at our school. Teachers thought that:

- it was easier to teach knowledge-based content of the National Curriculum, but more difficult to plan for working scientifically;
- whole-class enquiry activities limited pupil participation, but were being undertaken because of restricted timetables;
- children should have opportunities to investigate and explore independently;
- science was difficult to assess.

Figure 3 Working at one of the Investigation Stations

Alongside the overarching aim of the Year of Science, to use literacy skills to develop deep thinking in science, these challenges identified were used to develop three aims for our action research project:

- to plan effectively for working scientifically;
- to use literacy skills to develop deep thinking in science (focusing on children asking questions, describing their observations and giving a reasoned opinion);
- to assess science effectively.

Planning and enacting changes

To enable effective planning for working scientifically, teachers worked in year-group teams to plan schemes of work that had a balance between knowledge and enquiry-based activities, and a mix of whole-class and small-group enquiries. Teachers delivered the schemes of work with the understanding that we would collaboratively evaluate their impact upon teaching and learning. We evaluated that enquiry-based activities were more effective when carried out in small groups for two reasons. Firstly, group work maximised pupil talk and participation. It gave individual children the opportunity to work practically, describe their observations and share their ideas relating to predictions, conclusions and reasoned opinions. Secondly, it enabled teachers to assess children's knowledge and skills more effectively. Year 1 (ages 5–6) staff used their early years' experience to record learning as 'learning stories', which included photographs and direct quotes from children. The staff decided to adopt this approach across all classes as it provided quality evidence for teachers' assessment judgements.

In the early stages of the project, teachers shared concerns about the difficulties our children were having in generating questions. In response to this, 'Investigation Stations' were set up in each class. The stations were identical in each class and included a display with question prompts and question slips for the children's recordings (Figures 1 and 3). As science lead, I carried out a weekly activity with two 'science ambassadors' from each class. These activities were designed to provide awe and wonder and, in turn, help the children to generate questions. The ambassadors then set the activity up in their classrooms and shared it with peers. Children worked at the stations and their questions were discussed as a class throughout the week.

The impact and next steps

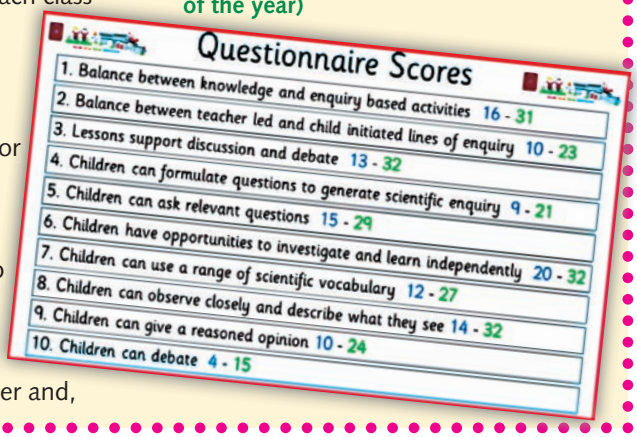
The impact was measured through our discussions about planning, lessons, children's engagement and work examples throughout the year. A questionnaire was also issued to the teachers at the beginning and end of the year. All teachers thought that the teaching and learning of science in our school had improved (Figure 4).

I have now refined schemes of work for every class topic, to include both whole-class knowledge-based activities and small-group enquiry work. I also amended our assessment documents and linked the assessment statements to each planned activity.

We will now implement these planning and assessment tools and continue with our Investigation Station activities. We will also continue to evaluate our practice, to ensure the children develop deep thinking in science while improving their spoken language skills. We are aware of the challenges associated with time restraints and the manageability of teacher assessment in busy key stage 1 (ages 5–7) classrooms, but we are certainly up for the challenge!

Perhaps most importantly, this project has put the teaching and learning of science on the school improvement agenda, a step that will undoubtedly lead to a more enriching and engaging science curriculum for our children.

Figure 4 Results of the teachers' questionnaire (a scale of 0–10 was used to judge each statement: blue font = beginning of the year; green font = end of the year)



A Year of Science at Wingate Primary School (formerly Wingate Infant)

Sarah Lewis

Our aims

Following the September conference, our school decided to focus on promoting practical science in school. Responses from the initial audit showed that staff felt this was something the children thrived on, but that they, as teachers, often shied away from. Our focus was to increase the children's enthusiasm and engagement with science, alongside providing them with opportunities to develop their questioning skills. As well as auditing the teachers' views, I also explored the children's feelings towards science. Their responses were mixed, although '*boring*' was one of the most common responses (Figure 5).

Planning and enacting changes

As the science leader, I supported staff to include more investigations within their lessons by creating a document with website links to a range of investigations for each National Curriculum science topic. We wanted to place more emphasis on working scientifically, with staff being encouraged to conduct investigations that developed scientific reasoning and questioning skills. After three terms of egg dropping, seed planting and other investigations the enthusiasm was palpable!

We encouraged the children's enthusiasm by creating 'science ambassadors'; these selected children were trained by the Ogden Trust and given opportunities to lead experiments. They also presented their learning about Charles Darwin for the influential scientist competition. To keep the profile of science high throughout the year, we welcomed science-related visitors to the school, including visits from an animal specialist and the Rocket Project.

The impact and next steps

When I repeated my surveys in the summer term,

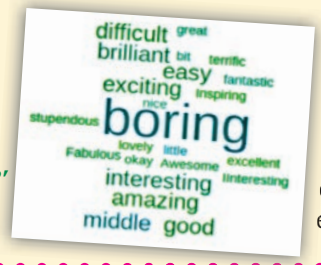


Figure 5 *'How would you describe science?'* **Pupils' responses in Autumn 2017**

Figure 6 *'How would you describe science?'* **Pupils' responses in Summer 2018**

the responses could not have been more different (Figure 6)! The teachers thought that the early years and key stage 1 children had become more confident about what science is and the role of a scientist. Early-years children were especially engaged with this year, using investigations to develop the 'communication' strand of the foundation stage assessment. In key stage 1, children gained confidence and skills to ask questions, leading to the creation of our 'Wonder Wall', a space where children's questions were displayed with pride, and used to fuel classroom activities and investigations.

Looking forward, we are enthusiastic about continuing with our science ambassadors and providing further opportunities for children to explore science through extra-curricular activities.

A Year of Science at Our Lady of Lourdes RC Primary School

Aleesha Hoggarth

Our aims

We were aiming for our children to become excited about science, by raising the profile of science in our school. We wanted the children to develop their questioning and debating skills, alongside improving how we gathered evidence for working scientifically.

Planning and enacting changes

Information gathered from teachers' questionnaires indicated that they often struggled to think of an experiment that linked to particular science topics (e.g. rocks and soils). Teachers became enthused about the prospect of easily organised science investigations stemming from children's 'wonder' questions in science, rather than specifically linked to a topic. Therefore, we began science topics with a 'wonder session', which allowed the children to voice their scientific wonders. My favourite was a key stage 1 pupil's wonder: '*If aeroplanes are so heavy, why do aeroplanes not fall out of the sky?*' Upper key stage 2 (ages 9–11) focused on their debating skills, which were recorded at the start of the year and again at the end, to analyse the impact. Ultimately, we had some great debaters by the end of the summer term!

We also researched a range of influential scientists. Children from all year groups absolutely loved this activity as it made science come to life for them and gave their science lessons a real purpose. We presented the life and work of Rosalind Franklin at the inter-school influential scientists competition.

I trialled a 'working scientifically floor book' with my year 2 class (ages 6–7), to gather evidence of the science that was taking place in the classroom. As well as being a great tool for assessment purposes, the children took ownership of the floor book and were proud to see how much exploring they had taken part in by the end of the year.

The impact and next steps

We now have teachers who are excited and enthusiastic about science again, alongside children who are desperate to share with others their science experiments. Some children are even considering future careers as scientists, which we see as such a positive outcome!

Conclusions

What has certainly emerged from our perspective in initial teacher education, and from the school-based projects, is that there is an appetite for developing science. With a concentrated effort great changes can be made to teachers' and pupils' views of science. Sustaining and embedding this is the next challenge, but it is one that we are all now far more convinced is a battle well worth fighting.

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